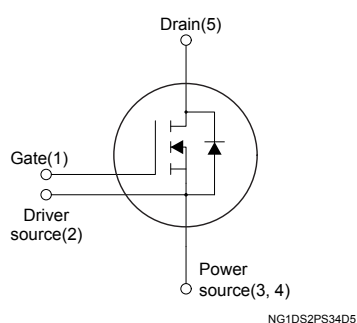
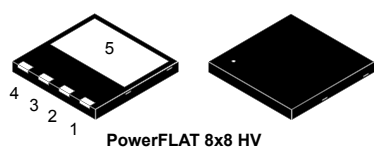


Silicon carbide Power MOSFET 650 V, 18 mΩ typ., 40 A in a PowerFLAT 8x8 HV package



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
SCTL90N65G2V	650 V	24 mΩ	40 A

- Very fast and robust intrinsic body diode
- Low capacitances
- Source sensing pin for increased efficiency

Applications

- Switching mode power supply
- DC-DC converters
- Industrial motor control

Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 2nd generation SiC MOSFET technology. The device features remarkably low on-resistance per unit area and very good switching performance. The variation of switching loss is almost independent of junction temperature.



Product status link

[SCTL90N65G2V](#)

Product summary

Order code	SCTL90N65G2V
Marking	90N65G2V
Package	PowerFLAT 8x8 HV
Packing	Tape and reel

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	650	V
V_{GS}	Gate-source voltage	-10 to 22	V
	Gate-source voltage (recommended operating values)	-5 to 18	
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	40	A
	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	40	
$I_{DM}^{(2)}$	Drain current (pulsed)	160	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	935	W
T_{stg}	Storage temperature range	-55 to 175	$^{\circ}\text{C}$
T_J	Operating junction temperature range		$^{\circ}\text{C}$

1. Value limited by package.
2. Pulse width is limited by safe operating area.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.16	$^{\circ}\text{C}/\text{W}$
$R_{thJB}^{(1)}$	Thermal resistance, junction-to-board	45	$^{\circ}\text{C}/\text{W}$

1. When mounted on an 1-inch² FR-4, 2 Oz copper board.

2 Electrical characteristics

($T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified).

Table 3. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	650			V
I_{DSS}	Zero gate voltage drain current	$V_{DS} = 650\text{ V}$, $V_{GS} = 0\text{ V}$			10	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = -10\text{ to }22\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 1\text{ mA}$	1.8	3.2	5.0	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 18\text{ V}$, $I_D = 40\text{ A}$		18	24	m Ω
		$V_{GS} = 18\text{ V}$, $I_D = 40\text{ A}$, $T_J = 175\text{ }^{\circ}\text{C}$		27		

Table 4. Dynamic, based on HiP247 package option

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 400\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	3380	-	pF
C_{oss}	Output capacitance		-	294	-	pF
C_{rss}	Reverse transfer capacitance		-	49	-	pF
R_g	Gate input resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	1	-	Ω
Q_g	Total gate charge	$V_{DD} = 400\text{ V}$, $I_D = 50\text{ A}$, $V_{GS} = -5\text{ V to }18\text{ V}$	-	157	-	nC
Q_{gs}	Gate-source charge		-	43	-	nC
Q_{gd}	Gate-drain charge		-	42	-	nC

Table 5. Switching energy (inductive load), based on HiP247 package option

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching energy	$V_{GS} = -5\text{ to }18\text{ V}$, $V_{DD} = 400\text{ V}$,	-	130	-	μJ
E_{off}	Turn-off switching energy	$I_D = 50\text{ A}$, $R_G = 2.2\text{ }\Omega$	-	210	-	μJ
E_{on}	Turn-on switching energy	$V_{GS} = -5\text{ to }18\text{ V}$, $V_{DD} = 400\text{ V}$,	-	135	-	μJ
E_{off}	Turn-off switching energy	$I_D = 50\text{ A}$, $R_G = 2.2\text{ }\Omega$, $T_C = 150\text{ }^{\circ}\text{C}$	-	200	-	μJ

Table 6. Switching times, based on HiP247 package option

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$, $I_D = 50\text{ A}$, $R_G = 2.2\text{ }\Omega$, $V_{GS} = -5\text{ V to }18\text{ V}$	-	26	-	ns
t_f	Fall time		-	16	-	ns
$t_{d(off)}$	Turn-off delay time		-	58	-	ns
t_r	Rise time		-	38	-	ns

Table 7. Reverse SiC diode characteristics, based on HiP247 package option

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{SD}	Forward on voltage	$I_F = 30\text{ A}$, $V_{GS} = 0\text{ V}$	-	2.5	-	V
t_{rr}	Reverse recovery time	$I_F = 50\text{ A}$, $di/dt = 4000\text{ A}/\mu\text{s}$, $V_{DD} = 400\text{ V}$	-	17	-	ns
Q_{rr}	Reverse recovery charge		-	308	-	nC
I_{RRM}	Reverse recovery current		-	30	-	A

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

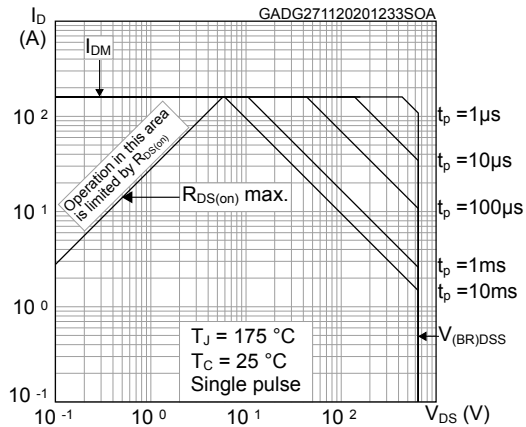


Figure 2. Maximum transient thermal impedance

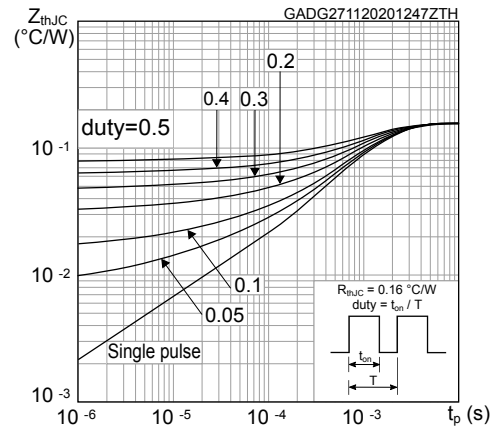


Figure 3. Typical output characteristics (T_J = -50 °C)

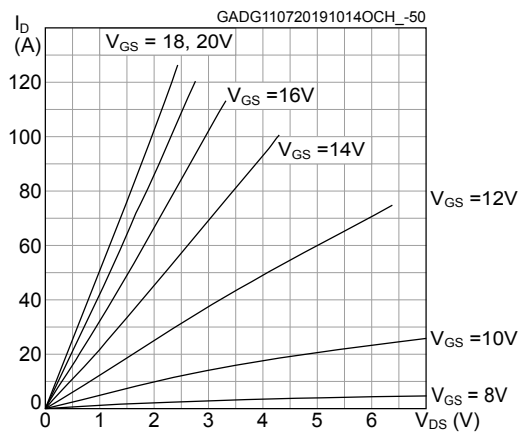


Figure 4. Typical output characteristics (T_J = 25 °C)

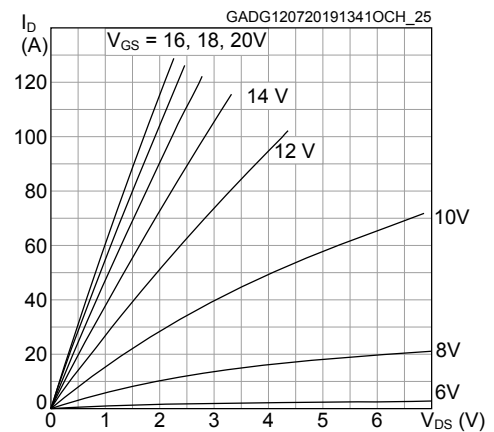


Figure 5. Typical output characteristics (T_J = 175 °C)

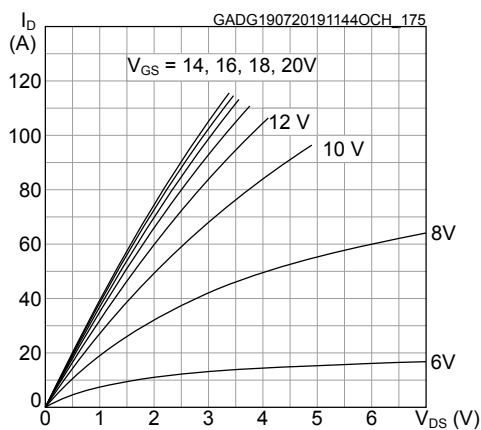


Figure 6. Typical transfer characteristics

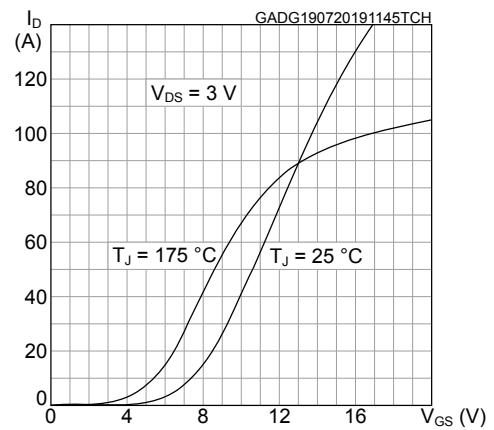


Figure 7. Typical capacitance characteristics, based on HiP247 package option

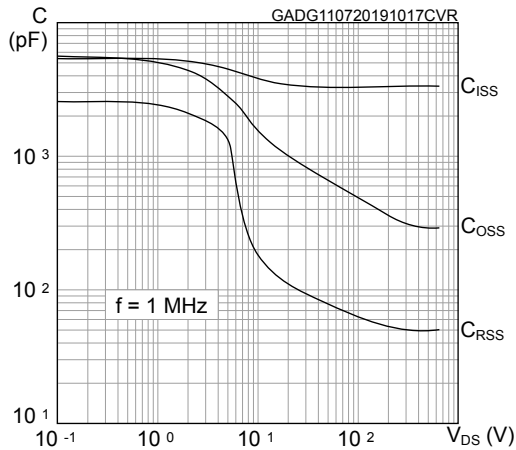


Figure 8. Typical gate charge characteristics, based on HiP247 package option

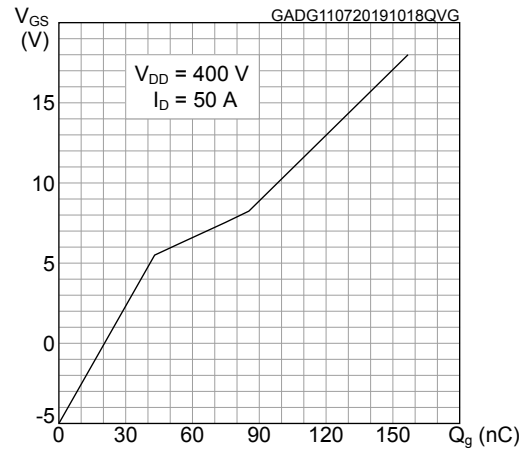


Figure 9. Total power dissipation

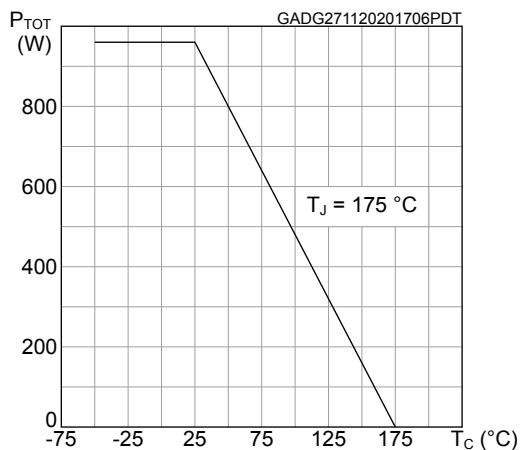


Figure 10. Normalized on-resistance vs temperature

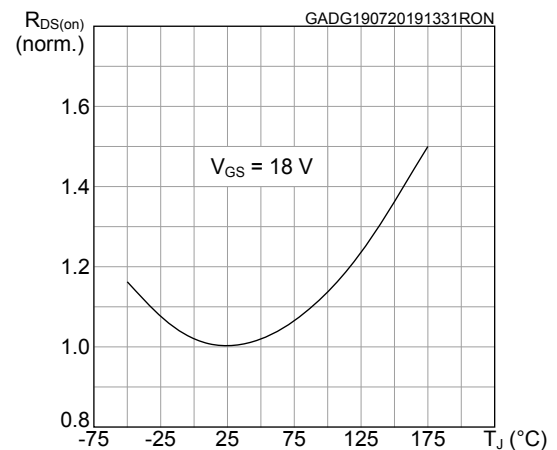


Figure 11. Normalized gate threshold vs temperature

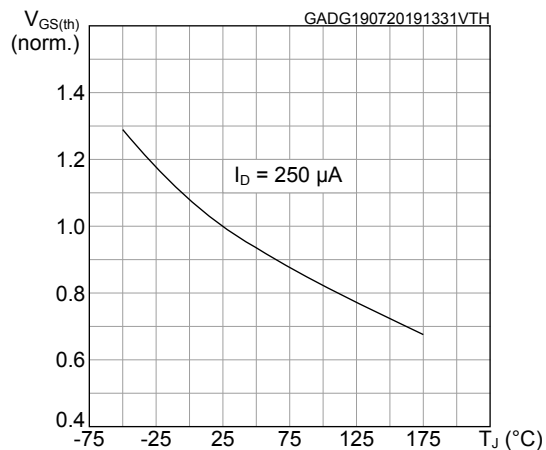


Figure 12. Normalized breakdown voltage vs temperature

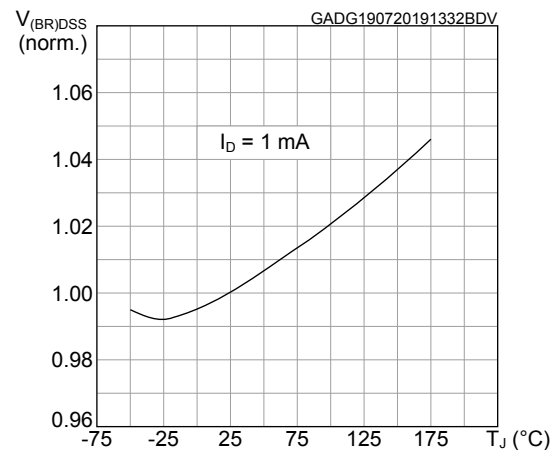


Figure 13. Typical switching energy vs drain current, based on HiP247 package option

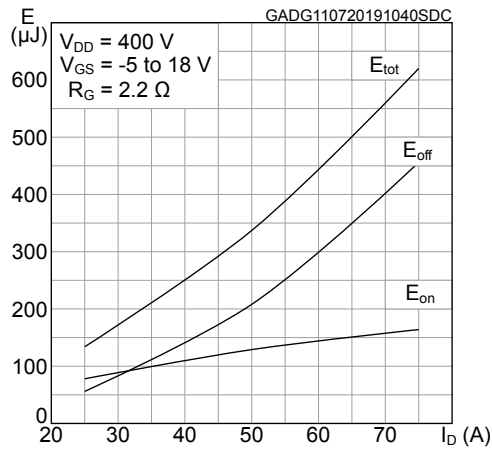


Figure 14. Typical switching energy vs temperature

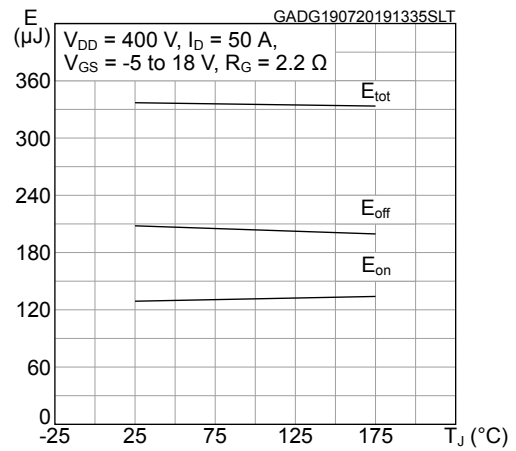


Figure 15. Typical reverse conduction characteristics (T_J = -50 °C)

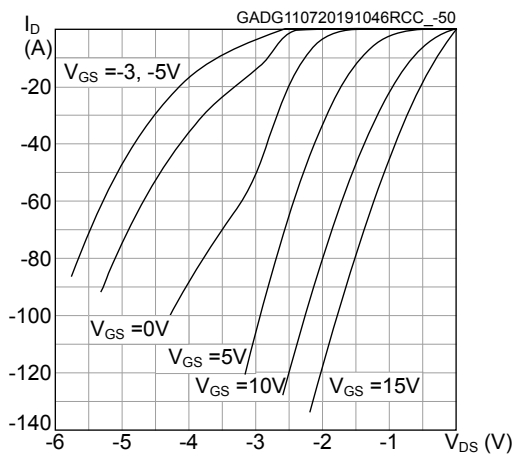


Figure 16. Typical reverse conduction characteristics (T_J = 25 °C)

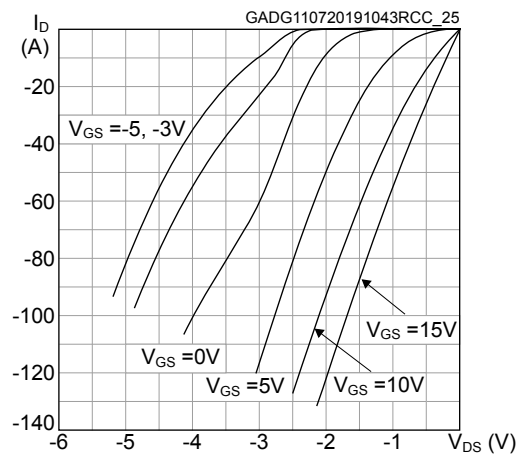
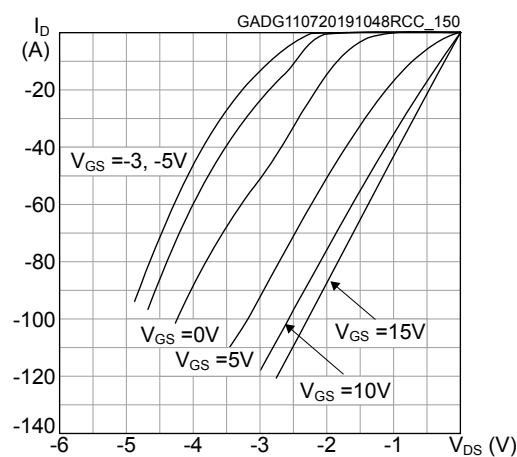


Figure 17. Typical reverse conduction characteristics (T_J = 150 °C)

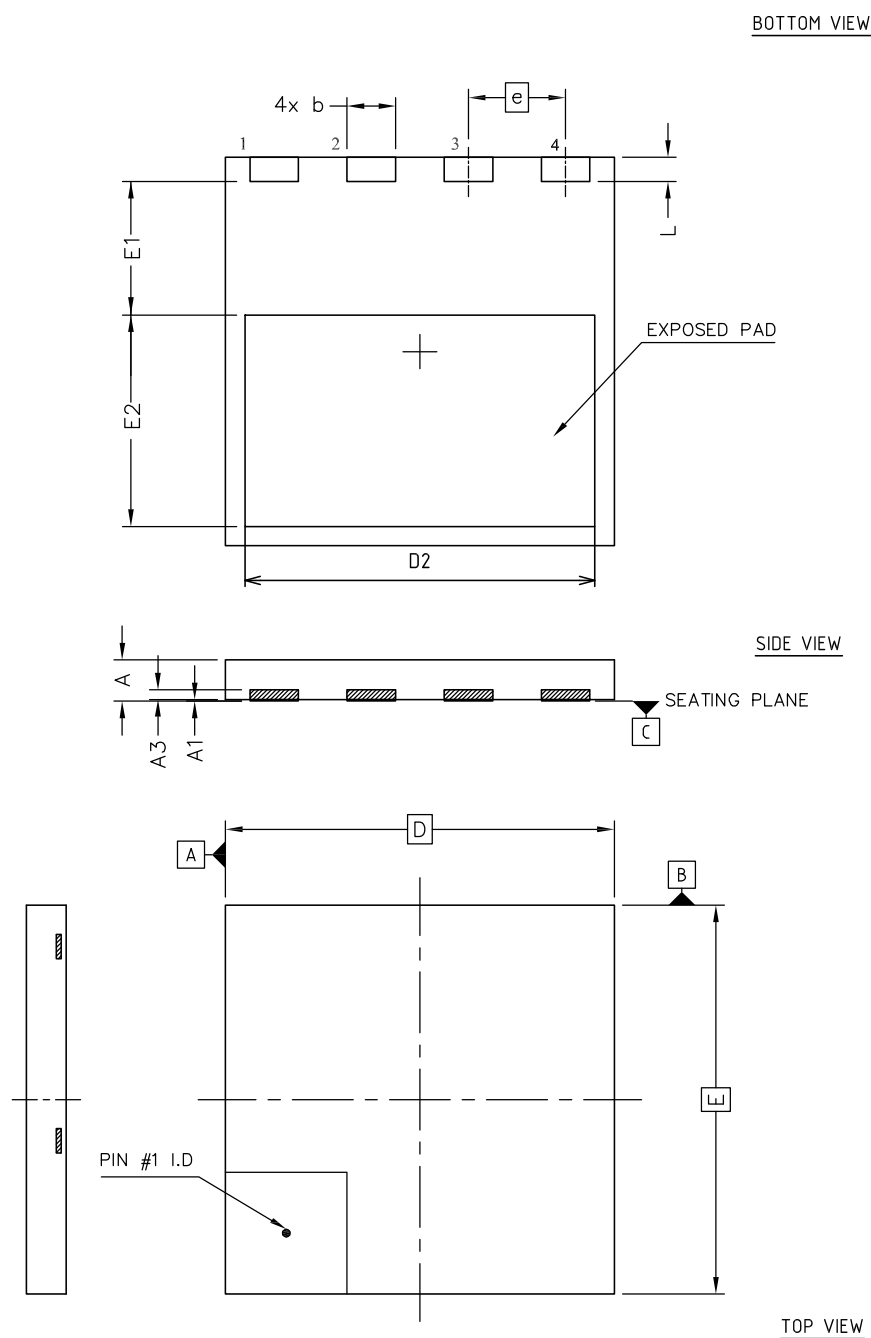


3 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

3.1 PowerFLAT 8x8 HV type A package information

Figure 18. PowerFLAT 8x8 HV type A package outline

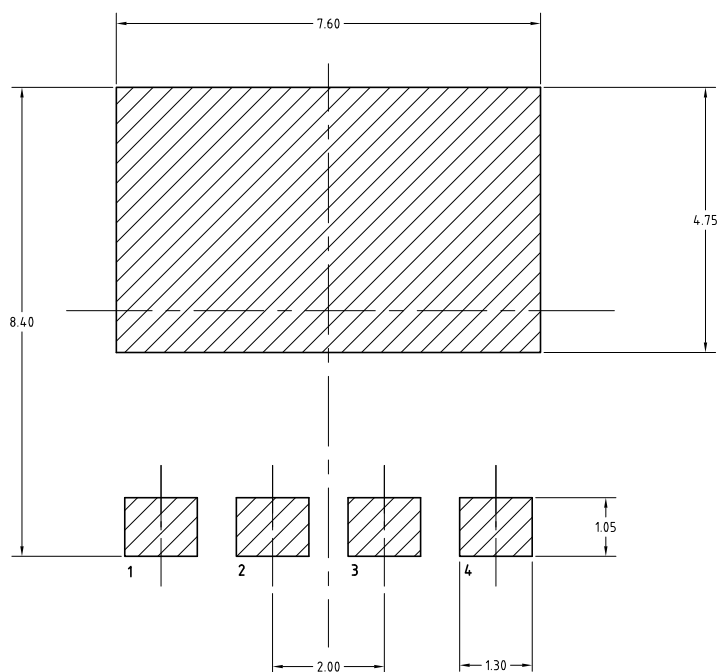


8222871_Rev_4

Table 8. PowerFLAT 8x8 HV type A mechanical data

Ref.	Dimensions (in mm)		
	Min.	Typ.	Max.
A	0.75	0.85	0.95
A1	0.00		0.05
A3	0.10	0.20	0.30
b	0.90	1.00	1.10
D	7.90	8.00	8.10
E	7.90	8.00	8.10
D2	7.10	7.20	7.30
E1	2.65	2.75	2.85
E2	4.25	4.35	4.45
e	2.00 BSC		
L	0.40	0.50	0.60

Figure 19. PowerFLAT 8x8 HV footprint

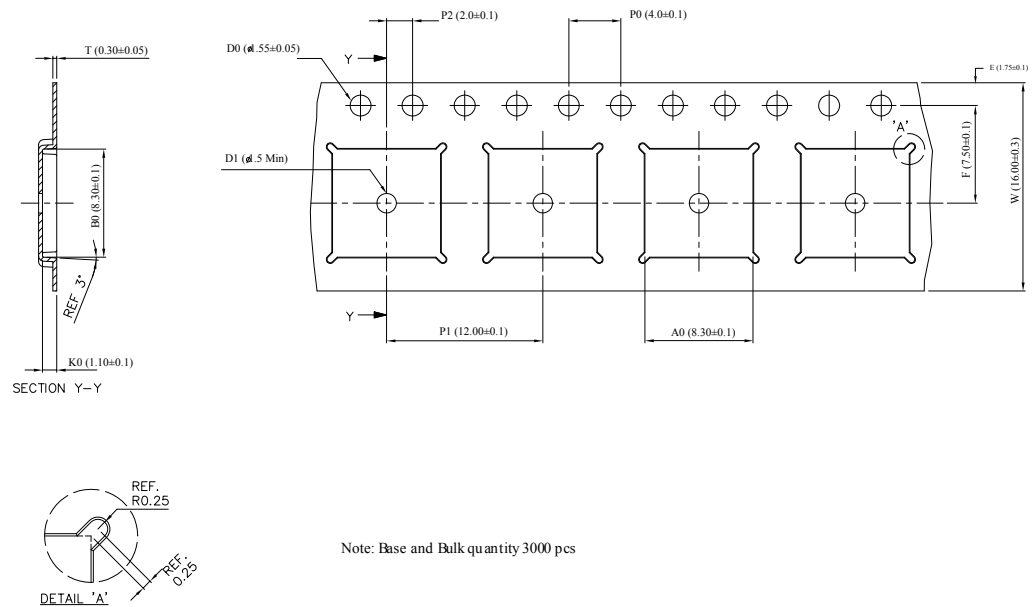


8222871_REV_4_footprint

Note: All dimensions are in millimeters.

3.2 PowerFLAT 8x8 HV packing information

Figure 20. PowerFLAT 8x8 HV tape



8229819_Tape_revA

Note: All dimensions are in millimeters.

Figure 21. PowerFLAT 8x8 HV package orientation in carrier tape

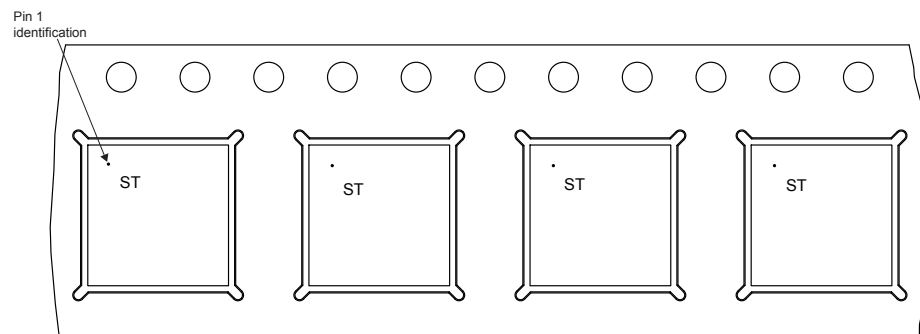
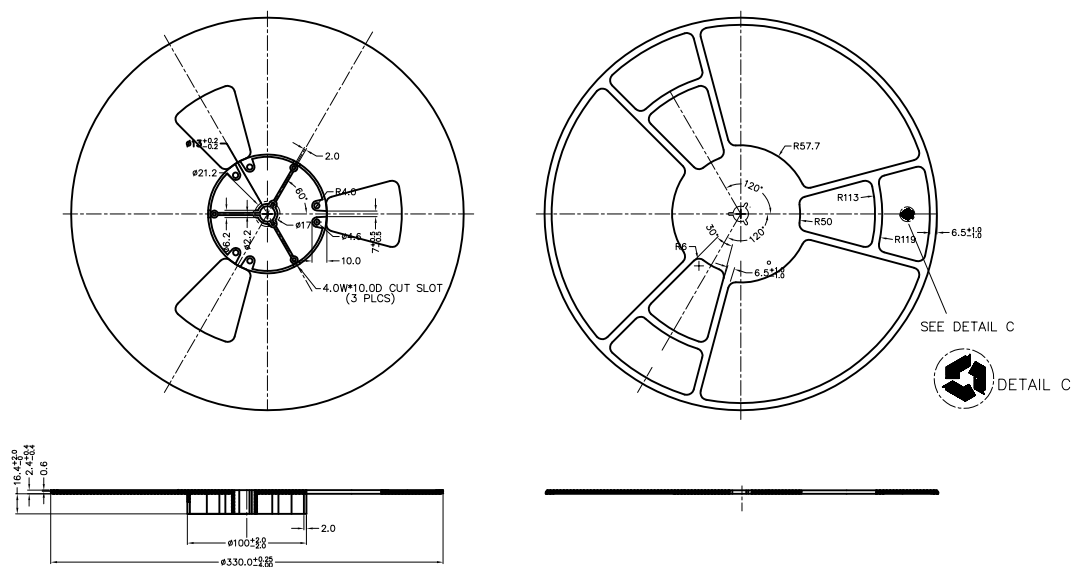


Figure 22. PowerFLAT 8x8 HV reel



8229819 Reel_revA

Note: All dimensions are in millimeters.

Revision history

Table 9. Document revision history

Date	Version	Changes
10-Dec-2020	1	First release.

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